Evaluation of Physical Stability of Lip Balm Preparation from Ethanol Extract of Tomato Fruit (*Solanum Lycopersicum* L.)

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Lips is part skin that has layer thinner than part body other so that more prone to experience drought And damage consequence exposure factor environment. One of the efforts that can be made done For guard humidity lips is use of lip balm. Research This aim For formulate lip balm preparation containing extract ethanol fruit tomatoes (*Solanum lycopersicum* L.) with addition of vitamin E and evaluate stability physical. Research use method experimental laboratory with four formulas, namely F0 (without extract tomato), F1 (3%), F2 (5%), and F3 (7%). Evaluation stability physique covering test organoleptic, homogeneity, pH, power sticky, power spread, and test favorite panelists. Results study show that all lip balm formulas have characteristics good physique with semi- solid form, texture soft, and stable aroma. The pH value of the preparation is at on appropriate range of 5.5 –6.3 with physiological pH skin lips. Analysis statistics use test Kruskal –Wallis shows mark significance of 0.538 (p> 0.05) which indicates No there is difference significant between formulas. Research This show that extract ethanol fruit tomato can formulated in stable lip balm preparation And potential developed as material active experience in product maintenance lips.

Keywords : lip balm, extract tomatoes, stability physical, cosmetic experience.

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1. Introduction

Lips are a facial area with thinner skin than other parts of the body and lack sweat glands and sebaceous glands. This condition makes lips more susceptible to dryness, chapping, and discoloration due to environmental factors such as sun exposure, extreme temperatures, and free radicals. Therefore, using lip care products is important to maintain moisture, protect the surface of the lips, and improve the overall appearance of the lips. One commonly used product for this purpose is lip balm, which helps maintain moisture and provides a protective layer on the surface of the lips. [5], [6], [8]

As public awareness of the safety of cosmetics increases, the use of natural ingredients in skincare product formulations is gaining popularity. Natural cosmetics are considered safer and carry a relatively lower risk of side effects compared to synthetic ingredients. Furthermore, natural ingredients can provide additional biological benefits for the skin. Lip balm, as a topical preparation, is generally formulated from a mixture of waxes, oils, and emollients, which function to form a protective layer on the surface of the lips, reducing water loss and maintaining the lips' natural moisture.[7], [11], [12]

One natural ingredient with potential use in lip balm formulations is tomatoes (*Solanum lycopersicum* L.). Tomatoes are known to contain various bioactive compounds such as flavonoids, lycopene, and vitamin C, which act as antioxidants. These antioxidant compounds can help ward off free radicals, maintain

hydration, and support healthy and elastic lip skin. The use of tomato ethanol extract in cosmetic preparations has also been reported to have good physical stability and organoleptic acceptance by consumers.[9], [13]

Physical stability is a critical parameter in cosmetic product development because it impacts product quality, safety, and consistency during storage. Physical stability evaluation is necessary to ensure that the product continues to meet quality requirements and remains safe for use throughout the product's shelf life. Based on the description, this study aims to formulate a lip balm preparation based on tomato fruit ethanol extract with varying concentrations and evaluate its physical stability to determine the best formula that is safe, stable, and acceptable to users.

2. Literature Review and Problem Statement

Lip balm is a cosmetic preparation used to maintain lip moisture and protect the surface of the lips from environmental influences such as free radicals, extreme temperatures, and sun exposure. Lip balm formulations generally consist of base ingredients such as wax, oil, and additional ingredients that function as emollients and antioxidants to maintain stability and increase the product's benefits on the skin of the lips. The use of natural ingredients in cosmetic formulations is increasingly being developed because they are considered to have good biological activity and are relatively safe for the skin. One natural ingredient that has the potential to be used is tomatoes (*Solanum lycopersicum* L.), which are known to contain bioactive compounds such as lycopene, flavonoids, and vitamin C, which have antioxidant activity. These contents play a role in protecting cells from damage caused by free radicals and help maintain skin health.[6], [10], [13] In addition, several studies report that tomato extract can be used in the development of cosmetic preparations because it has the potential as a natural active ingredient that can provide protective and care benefits for the skin.[3], [9]

However, the development of natural lip balm formulations requires adequate physical stability evaluation to ensure product quality, safety, and effectiveness during storage. The physical stability of a cosmetic preparation is greatly influenced by the composition of the ingredients, the concentration of active ingredients, and the addition of supporting ingredients such as antioxidants. Vitamin E is one of the antioxidants frequently used in cosmetic formulations because it can increase the stability of the preparation and help protect the active components from the [1], [4] oxidation process. However, research on lip balm formulations utilizing tomato fruit ethanol extract with the addition of vitamin E and evaluation of its physical stability is still limited. Therefore, research is needed to formulate a lip balm preparation based on tomato fruit ethanol extract with the addition of vitamin E and evaluate its physical stability to determine the characteristics and quality of the resulting preparation.

3. Method

This study used a laboratory experimental approach aimed at formulating and evaluating the physical stability of a lip balm preparation made from ethanol extract of tomato fruit (*Solanum lycopersicum* L.). The experimental method was chosen because it is able to provide more accurate and controlled results in observing the effect of formulation variations on the physical characteristics of the preparation. The study was conducted through several main stages, namely the material preparation process, extract making, lip balm preparation formulation, and product physical stability testing. Tomato fruit extraction was carried out using ethanol solvent because this solvent is effective in attracting active compounds such as flavonoids, vitamin C, and lycopene which act as natural antioxidants[8], [13] The use of antioxidant

compounds in cosmetic formulations is important to help protect active components from the oxidation process and increase product stability during storage.[1]

Figure 1. Tomato fruit

The samples in this study were lip balm preparations formulated with tomato fruit ethanol extract in several concentrations, then their physical characteristics were compared to determine the best formula. The basic ingredients used in the lip balm formulation include wax, oil, and additional ingredients such as emollients and antioxidants that function to form a protective layer on the surface of the lips and maintain moisture [7], [11]. After the formulation process was completed, the lip balm preparations were then evaluated through several physical stability test parameters, including organoleptic tests, homogeneity, pH, spreadability, and stability during storage. This test was carried out to ensure that the resulting preparation has good quality, is stable, and is safe to use. Data obtained from each test were analyzed descriptively to assess the suitability of the preparation's characteristics with applicable cosmetic quality standards.

4. Results and Discussion

The results of this study on the formulation of lip balm preparations from ethanol extract of tomato (*Solanum lycopersicum* L.) with the addition of vitamin E are presented in tables and figures to illustrate patterns, trends, and comparisons among formulations. Four formulations were prepared, namely F0 (without tomato extract), F1 (3%), F2 (5%), and F3 (7%). The evaluation of physical stability included organoleptic, homogeneity, pH, adhesion, spreadability, and panelist preference tests.

Phytochemical Screening

Phytochemical screening showed that the ethanol extract of tomato fruit contained flavonoids, as indicated by the formation of a yellow precipitate after the addition of Pb-acetate reagent. This result suggests that the extract has potential antioxidant activity.

Organoleptic Test

The organoleptic test showed that all lip balm formulations had a semi-solid form, soft texture, and stable aroma. The color of the formulations became more yellowish with increasing concentrations of tomato extract.

Homogeneity Test

All formulations showed good homogeneity without the presence of coarse particles, indicating a uniform distribution of ingredients in the preparation.

pH Test

The pH values of all formulations ranged from 5.5 to 6.3, which falls within the normal physiological pH range of the lips and indicates that the preparations are safe for use.

Adhesion Test

The adhesion test showed values above 4 seconds, indicating good adherence and compliance with the standard requirements for lip cosmetic preparations.

Spreadability Test

The spreadability of the formulations decreased with increasing concentrations of tomato extract, which is likely due to the increased viscosity of the preparation.

Panelist Preference Test

The panelist preference test showed that most respondents rated the color and texture of the lip balm as "very good." The addition of tomato extract enhanced the natural color and improved overall product acceptability.

Statistical Analysis

Statistical analysis using the Kruskal–Wallis test showed no significant difference between the formulations ($p > 0.05$), indicating that variations in extract concentration did not significantly affect the physical stability of the lip balm preparations.

The overall results of the physical stability evaluation of the lip balm formulations are presented in Table 1.

Table 1. Summary of the Results of the Evaluation of the Physical Stability of the Tomato Fruit Ethanol Extract Lip Balm Preparation

Aspect	Information
Key Findings	The results showed that all lip balm formulas had good physical stability based on organoleptic parameters, pH, homogeneity, adhesion, and spreadability. The pH values were within a safe range for lip skin, and there were no significant differences between the formulas based on the Kruskal-Wallis test.
Comparison with Previous Research	The results of this study are in line with research which states that tomato fruit extract contains flavonoids and has good antioxidant activity so it has the potential to be used in cosmetic formulations [2], [13]
Phenomena and Explanation	Increasing the concentration of tomato extract affects the color and spreadability of the preparation. The higher the concentration, the darker the color, and the less spreadable the preparation due to the increased viscosity.
Initial Conclusion	In general, the formulation of tomato fruit ethanol extract lip balm with the addition of vitamin E produces a physically stable preparation and is acceptable to panelists so that it has the potential to be developed as a natural cosmetic product for lip care.

Based on Table 1, all formulations showed good physical stability in terms of organoleptic properties, homogeneity, pH, adhesion, and spreadability. The results indicate that the addition of tomato extract did not negatively affect the overall quality of the lip balm preparation.

To strengthen the validity of the results, the findings of this study were compared with previous relevant studies. The results showed that the use of tomato fruit ethanol extract in lip balm formulations produced preparations with good physical stability, particularly in organoleptic properties, homogeneity, and pH. These findings are consistent with previous studies which reported that tomatoes contain bioactive compounds such as flavonoids, vitamin C, and lycopene with antioxidant activity, making them suitable for use in natural cosmetic formulations[2], [13] In addition, other studies have shown that antioxidant compounds can improve the stability and quality of cosmetic preparations during storage.[1]

The results also showed that increasing the concentration of tomato extract affected the physical characteristics of the lip balm, particularly color and spreadability. Higher extract concentrations resulted in a more intense color and decreased spreadability, which may be attributed to increased viscosity of the formulation. However, the pH values remained within a safe range and did not differ significantly between formulations based on the Kruskal–Wallis test ($p > 0.05$). These findings indicate that variations in extract concentration and the addition of vitamin E still produce physically stable preparations that meet cosmetic quality requirements.

Overall, the lip balm formulation containing tomato fruit ethanol extract demonstrated good physical stability and met the required quality standards. In addition to its functional role as a natural antioxidant, the extract also contributed to the visual characteristics of the preparation, such as producing a more natural color. These findings suggest that tomato fruit extract has strong potential as a natural active ingredient in the development of lip care cosmetic products. Further studies are recommended to evaluate long-term stability and biological effectiveness.

5. Conclusion

Based on the research results, ethanol extract of tomato (*Solanum lycopersicum* L.) can be formulated into a lip balm preparation with good and stable physical characteristics. All formulas showed evaluation results that met the quality standards for lip cosmetics, including organoleptic, homogeneity, pH, adhesion, and spreadability. The addition of tomato extract affected the color characteristics and spreadability of the preparation, but did not significantly affect the pH.

This study demonstrates that tomato fruit extract has the potential to be used as a natural active ingredient in the development of lip care cosmetic products due to its antioxidant properties. However, this study is limited by its relatively short stability testing period. Therefore, further research is recommended to conduct long-term stability tests and more in-depth evaluation of antioxidant activity to strengthen the results.

6. References

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